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EXPLORING THE ROLE OF INFORMATION SYSTEMS RESOURCES IN DYNAMIC ENVIRONMENTS

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Abstract

This study seeks to understand the role of information systems (IS) resources in dynamic environments. To date, 30 interviews have been conducted with senior managers in charge of online retail commerce operations. The results appear to challenge the research literature both in terms of the composition of IS resources and the role that they play in sustained competitiveness. This paper describes preliminary results from the first phase of a multi-phase study on how IS resources affect the firm.

Keywords: Dynamic environments, sustained competitiveness, resource-based view, strategic information technologies.

RESEARCH OBJECTIVES AND QUESTIONS

The effect of information systems (IS) on a firm's competitive position has been one of the more enduring streams in the IS literature to date (Zaheer and Dirks 1999). Researchers have long wondered about the ultimate effect IS have on firm level variables such as performance and sustained competitive advantage (SCA). Practitioners, also, have shown a keen interest in ways to determine returns on their (often significant) IS investments. With few exceptions, however, the link between IS and firm performance has proven elusive.[1] Despite the difficulty that researchers have had in defining a performance-IS link, the issue remains one of intense interest to researchers and practitioners alike.

The objective of this research is to further explore the link between IS resources and firm-level SCA. The research specifically looks at this link in a dynamic environment. A dynamic environment is one characterized by rapid and discontinuous change (Teece et al. 1997). Recent research in strategic management has made a clear distinction between strategy and operations in stable and dynamic environments (Miller and Shamsie 1996). For purposes of this research, a dynamic environment is characterized by the online retail commerce market (Christensen and Tedlow 2000; Rosen and Howard 2000). The conceptual foundations of the study are drawn from the resource-based view of the firm (RBV), an influential theory in strategic management and one that is finding increasing use in IS research.

The research questions for this study are:

RQ1: What IS resources contribute to SCA in a dynamic environment?
RQ2: How do IS resources lead to SCA in a dynamic environment?

The first research question is concerned with developing a list of IS resources that contribute to SCA in a dynamic environment. While a number of IS resource lists exist in the literature, they were developed in relatively stable environments (Feeny and

[1]See Brynjolfsson and Hitt (1996) and Bharadwaj et al. (1999) for exceptions.

Willcocks 1998; Ross et al. 1996). To use these existing resource lists would be to assume that resources are portable between stable and dynamic environments, an assumption which may not be tenable (Eisenhardt and Martin 2000).

The second research question seeks to determine *how* IS resources affect SCA, an area that has received scant coverage in the IS research literature to date. The answer to this question will come from an exploration (via a series of interviews) of the process by which IS resources contribute to SCA.

THEORETICAL FOUNDATIONS OF THE STUDY

This study draws heavily on the resource-based view of the firm. The RBV considers the firm as a bundle of resources (Barney 1991). A resource may be an asset (a thing such a management information system, a patent or a brand) or a capability (an action or a process such as a skill or an ability). Each firm's particular configuration of resources makes it unique among competitors. Clearly, not all resources within a firm lead to sustainable competitive advantage. In order to do so, resources must have certain attributes.[2] How these attributes relate to IS resources will be explored in the research.

While interest in the RBV within IS research is relatively new, interest in how IS affect competitiveness at the level of the firm is not. The IS literature is rich with examples of work attempting to define the role IS play in firm strategy, performance, and sustainability.[3] By the mid-1990s, the resource-based view was beginning to take hold in IS research. Fourteen studies were found that identified IS resources (i.e., Bharadwaj et al. 1998; Feeny and Willcocks 1998; Mata, et al. 1995).[4] While these resources are a significant contribution to the field from a conceptual standpoint, very little empirical work has been conducted to test how powerful and prevalent these resources are in the field.

RESEARCH METHODOLOGY

The researcher proposes to conduct in-depth interviews with 60 senior managers of online retail commerce firms. The online retail commerce market was chosen because of its dynamic nature (Christensen and Tedlow 2000; Rosen and Howard 2000), its size, and its reliance on IS (Powell and Dent-Micallef 1997). Since this research is essentially concerned with the conceptual development of resource categories, a theoretical sampling plan is appropriate. By obtaining a sample that reflects a diverse set of respondent organizations, the study will obtain a rich set of ideas and insights (Parkhe 1993). In order to strengthen internal validity, care will be taken to interview marginal firms and, where possible, failures in addition to successful firms.

There are two main arguments for why an interview methodology is appropriate for this research. The first, as noted previously, is based on a refusal to accept that literature-based IS resource categorizations are portable between stable and dynamic environments, and that they may in fact miss important elements. The second is the depth of contextual information that may be gathered in the field, which may not be readily available from the research literature. Since focus on dynamic environments is relatively new, such rich and contextual data can prove extremely valuable.

The sample population consists of managers with authority over strategic online commerce issues. Although titles vary greatly between firms, target respondents are members of the senior management team overseeing the firm's online commerce efforts. Examples taken thus far include vice presidents of e-commerce and of IS development services, president, and corporate CIO. Some of these managers are in general management positions, while others are in senior IS management positions. Both types of managers are being targeted. Where possible, to limit possible informant bias, two or more respondents from each organization are being interviewed.

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[2]SCA-conferring resource attributes include value, rarity, appropriability, durability, imitability, sustainability, and tradability.

[3]See Zaheer and Dirks (1999) for a review.

[4]The resources in these studies fit into 10 general categories: IS/business partnerships, IS infrastructure, IS management skills, management of external relationships, market responsiveness, IS technical skills, IS development, top management commitment, cost effective operations, and IS planning.

The sampling frame for field interviews comes from three sources: the membership list of the National Retail Federation (North America's largest retailing organization), the alumni of a large North American business school, and Monitor Consulting, a management consulting firm and partner in the research.

PRELIMINARY RESULTS

As is often the case when conducting field-based data collection, the emerging picture is more complicated than originally expected. To this point, 30 interviews have been conducted. In the first five interviews, a research associate accompanied the main researchers and took parallel notes. These notes were later compared and found to be consistent. Tape recordings have been made of all interviews, unless the interviewee requested otherwise (two cases). The data resulting from the interviews is organized into two parts The first part forms the list of IS resources leading to sustained success in a dynamic environment. This list is then compared to one developed from the IS literature. The second part consists of qualitative information about the role of IS resources in SCA.

List of Resources

The list of IS resources identified in this study provides an interesting comparison to that found in the research literature. Both are shown in Table 1.

Of the 10 resources to emerge from the IS literature, eight were also mentioned during the interviews. However, the other two resources were specifically noted as *not* being contributors of SCA. Five IS resources, which did not appear in the research literature, emerged from the field. These were environmental scanning, collaboration support, IS systems integration internal intelligence, and security. While each of these has been studied to some degree in the IS literature, none has thus far been mentioned in relation to studies incorporating the resource-based view.

Environmental scanning involves the use of IS to recognize opportunities and threats in the environment. The market responsiveness resource, in contrast, deals with the integration of external information once it has been identified. Collaboration support refers to the flow of information among parts of the firm. Intranets, groupware, and collaboration tools were all cited as systems that supported the dissemination and productive use of information throughout the firm. IS systems integration refers to the capability to integrate different information systems within the firm. Of particular importance to the interviewees was the ability to integrate different levels of often incompatible systems. For example, many interviewees spoke of the challenges of integrating a Web front end with (often legacy) databases, procurement systems, management systems, and middleware. Internal intelligence concerns the effective management of information within the firm. For example, the ability to monitor performance and "get the right information to the right people at the right time" was often mentioned as a key IS capability. Security refers to the management of data access, where the goal is to maximize data security while minimizing inefficiency.

It is interesting to note that the preliminary list of IS resources to come out of this study is different from the list from the IS literature. This suggests that the dynamic nature of the environment might affect the type of resources that affect firm-level variables such as SCA, something which has been hypothesized in the strategic management literature (Teece, et al. 1997). Further work in the area is clearly required.

Role of IS Resources in a Dynamic Environment

As suggested earlier, the relationship between IS resources and SCA appears to be more complex than initially expected. As the interviews progressed, two things became clear. First, the role of IS resources in a dynamic environment was not to provide a "direct path to SCA." Second, it became clear that an important distinction needed to be made between the *creation* of a competitive advantage and *sustaining* of advantage. Most of the research in IS to date has dealt with the former, while the latter has received significantly less attention.[5]

[5]See Feeny and Ives (1990) for an exception.

Table 1. Comparative List of Resources

Origin		IS resource	Description of resource from literature	Description of resource from study
Lit	Study			
✓	✓	Market responsiveness	Capability to integrate new external information	Capability to integrate new external information
✓	✓	IS development	Capability to develop new systems	Capability to experiment with new designs and develop systems
✓	✓	IS Planning	Capability to manage architectures and standards	Capability to manage architectures and standards and the make the correct protocol support decisions
✓	✓	Cost effective operations	Capability to provide efficient and cost effective operations	Capability to provide efficient and cost effective operations, focus on maintenance
✓	✓	IS/Business partnerships	Capability to align business and IS strategy	Capability to align business and IS strategy
✓	✓	Top management commitment	Visible and explicit support from senior management for IS initiatives	Visible and explicit support from senior management for IS initiatives
✓	✓	Manage external relationships	Capability to work effectively with outside customers and suppliers	Capability to work effectively with outside customers and suppliers, particularly developers
✓	✓	IS management skills	Capability to manage technical infrastructure and IS personnel	Capability to manage technical infrastructure and IS personnel with different technical skills
	✓	Environmental scanning		Capability to recognize opportunities and threats
	✓	Collaboration support		Capability to support the internal flow of information among parts of the firm
	✓	IS systems integration		Capability to integrate the information supply chain, particularly between new and legacy systems
	✓	Internal intelligence		Capability to manage data and monitor performance
	✓	Security		Capability to manage the access to internal and external data
✓		IS technical skills	Technical skills and capabilities	
✓		IS infrastructure	Hardware, software and network assets	

Rather than playing a direct role, IS resources in a dynamic environment appeared to play more of an indirect supporting role in achieving SCA. For example, the new IS resources shown in Table 1 appear largely to be capabilities that support other areas of the firm rather than create a competitive advantage directly. This role is consistent with prior research which concluded that strategic information technologies are necessary but not sufficient for SCA (Clemons and Row 1991). However, this supporting role has not been extensively explored.

Further, the support role that IS resources play in a dynamic environment appears to be more concentrated in sustaining a competitive advantage (created by another resource) than in creating one. An example provided by an interviewee was of a firm that had developed a capability for providing excellent customer service. Competitors were continually seeking to mimic this capability and thus erode the advantage. The company used information systems to extend the delivery of their customer service (through a Web interface), as well as improve the quality and depth of the service (an IS allowed them to access more extensive information, more quickly). The IS didn't create the advantage, but were essential in helping to sustain the advantage created by the firm's customer service capability.

The distinction between creating an advantage and sustaining one is not trivial. In a relatively stable environment, the bulk of management's effort is put toward creating competitive advantages for their firm. Since the environment changes little, any advantage is likely to be sustained over time (Miller and Shamsie 1996). By contrast, in a dynamic environment, any advantage

is likely to be short lived as competitive and environmental pressures seek to undermine any resource value or heterogeneity (Foss 1998). Thus, the challenge for management in a dynamic environment shifts from creating an advantage to sustaining it. The preliminary data suggests that IS resources are particularly useful in this regard.

Figure 1 shows an initial conceptualization of the difference between resource creation and resource sustainability, and the role of IS resources.

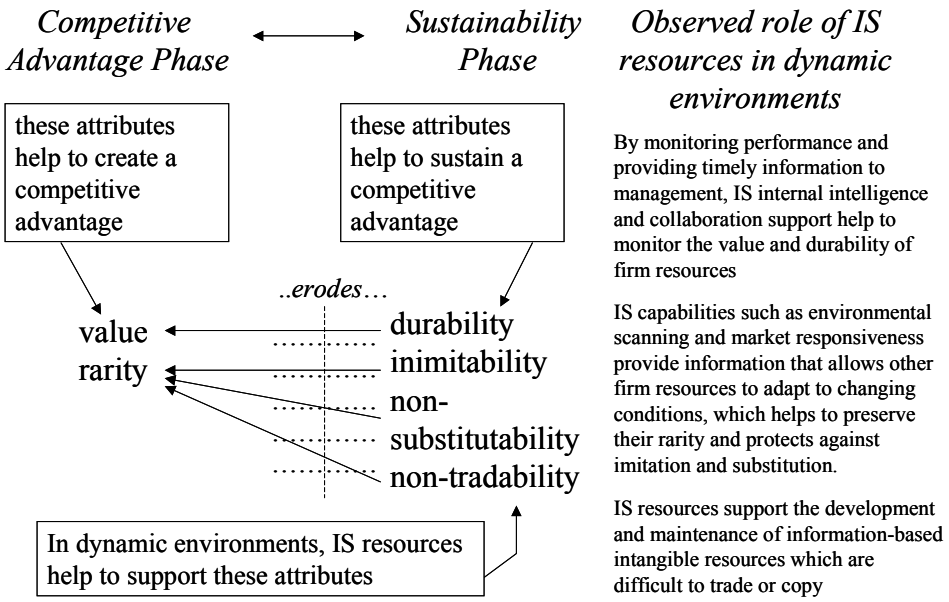

Figure 1. Role of Information Systems Resources in Dynamic Environments

In Figure 1, the SCA-conferring resource attributes are divided into those which help create a competitive advantage and those which help sustain the advantage once it has been created. Value and rarity are conditions which can lead to the creation of a competitive advantage. In practical terms, a resource must be of significant value and rare enough that competitors do not possess it (or have access to it). The results of this study suggest that while IS resources may be valuable, they are not often rare, and thus they often fail as creators of competitive advantage, at least in a dynamic setting.[6]

The attributes concerned with sustainability are durability, imitability, substitutability, and tradability. The durability of a resource affects a resource's value. As the resource deteriorates, its value decreases. An example of this is computer hardware, whose value is reduced as new and more sophisticated hardware is developed. A resource's imitability, substitutability, and tradability affect the resource's rarity. As resources are copied and traded, they become less rare, and thus any advantage is dissipated. All in all, these attributes erode a competitive advantage, and thus adversely affect the sustainability of that advantage.

The results from the interviews conducted to this point suggest that IS resources serve to reduce the rate of this erosion. This is a new insight about the role of IS resources in firm-level SCA. The results support the "necessary but not sufficient" status for IS resources, but specify the (largely overlooked) nature and significance of this support. Thus, in a dynamic environment where sustainability of competitive advantage takes on added importance, IS resources appear to play a critical strategic role.

This study draws heavily on the RBV for its conceptual foundations. Preliminary results of the study suggest that extensions to this theory are needed. First, the results suggest that the RBV may need to be adjusted for use in dynamic environments. Specifically, SCA may need to be considered as two separate dependent variables, one dealing with advantage creation and the other dealing with sustainability. The results of this study also suggest a possibly overlooked strategic benefit of IS resources.

[6]A number of authors in the strategic IS research stream suggested that first mover status could lead to IS-based sustained competitive advantage (Feeny and Ives 1990). By contrast, the interviewees regarded any IS-based first mover advantage benefit as minimal.

This benefit relates to the use of IS resources to help sustain strategic benefits created by other firm resources, particularly in dynamic environments.

CURRENT STATUS OF THE PROJECT

This paper presents partial results from the first phase of a multi-phase research project. Future phases include a large-scale cross sectional survey to empirically test the IS resource list against multiple firm-level dependent variables, and a series of in-depth case studies to understand more precisely the role of particular IS resources in static and dynamic environments.

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